DIN EN 12336:2010-03 (E)

Tunnelling machines - Shield machines, thrust boring machines, auger borin g machines, lining erection equipment - Safety requirements (includes Amendment A1:2008)

Contents

Page

Foreword 4

Introduction 5

1 Scope 6
1.1 Description of the machines 6
1.2 Hazards 6
1.3 Validity 6

2 Normative references 7

3 Terms, definitions symbols and abbreviated terms 8

4 List of significant hazards 10
4.1 Mechanical hazards 11
4.2 Electrical hazards 11
4.3 Thermal hazards 11
4.4 Hazards generated by noise 11
4.5 Hazards generated by radiation 11
4.6 Hazards generated by materials and substances 11
4.7 Hazards generated by neglect of ergonomic principles 11
4.8 Hazards caused by failure of energy supply 11
4.9 Hazards caused by missing and/or incorrectly positioned safety related measures 11

5 Safety requirements and/or protective measures 12
5.1 General 12
5.2 Specific requirements 12
5.2.1 Hazards due to sharp and rough parts 12
5.2.2 Hazards due to hot surfaces 12
5.2.3 Hoses, installation and shielding 12
5.2.4 Cutter head on TBMs 12
5.2.5 Handling of heavy loads 13
5.2.6 Rotation and displacement (axial movement) 13
5.2.7 High compressive loads 14
5.2.8 Access to and egress from operating positions and servicing points 14
5.2.9 Protection against falling objects, face collapse and flood 16
5.3 Control stations 16
5.3.1 General 16
5.3.2 Ergonomics 16
5.3.3 Visibility 16
5.4 Guards and protective devices 17
5.4.1 General 17
5.4.2 Specification of guards 17
5.4.3 Access to cutter head 17
5.4.4 Conveyor 17
5.5 Control devices and systems and safety circuits 17
5.5.1 Control devices 17
5.5.2 Control systems 18
5.5.3 Safety circuits 18

5.5.4 Starting and stopping and warning systems 18
5.5.5 Emergency stops 19
5.5.6 Failure of the power supply 19
5.6 Towing connection 20
5.7 Laser guidance 20
5.8 Ventilation and the control of dust and gas 20
5.8.1 General 20
5.8.2 Exhaust gases of internal combustion engines 20
5.8.3 Atmospheric changes and ingress of gases 20
5.9 Noise reduction 21
5.9.1 General 21
5.9.2 Noise reduction at source at the design stage 21
5.9.3 Noise emission determination 22
5.10 Electrical equipment 22
5.10.1 General 22
5.10.2 Protective measures 22
5.10.3 Cables and leads 23
5.10.4 Transformers 23
5.10.5 Earthing and bonding 23
5.10.6 Switch gear 23
5.10.7 Lighting 23
5.10.8 Emergency lighting 23
5.11 Isolation of high voltage power supply 23
5.12 Energy supply other than electricity 23
5.13 Fire prevention and protection 24
5.13.1 General 24
5.13.2 Fire extinguishing systems 24
5.13.3 Installation of fire extinguishing systems 24
5.14 Storage of rescue equipment 25
5.15 Forward probing equipment 25
5.16 Warning signs, warning devices, symbols 25
5.16.1 Warning signs 25
5.16.2 Warning devices 25
5.16.3 Symbols 25
5.17 Maintenance 25
5.17.1 General 25
5.17.2 Work on cutter heads 26

6 Verification of the safety requirements and/or protective measures 26

7 Information for use 26
7.1 General 26
7.2 Content of handbook 26
7.2.1 General instructions 26
7.2.2 Operating instructions 27
7.2.3 Maintenance 28
7.2.4 Spare parts 28
7.3 Marking 28

Annex A (informative) Examples of tunnelling machines 30

Annex B (normative) Verification of safety requirements and/or protective measures 38

Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC 41

Annex ZB (informative) !!!!Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC""""" 42

Bibliography 43